Proceedings of the 7th International Conference on Mechanics and Materials in Design
Albufeira/Portugal 11-15 June 2017. Editors J.F. Silva Gomes and S.A. Meguid.
Publ. INEGI/FEUP (2017)

PAPER REF: 6850

PERFORMANCE BASED SEISMIC DESIGN OF REINFORCED CONCRETE STRUCTURES IN MADINAH

Abdul Qadir Bhatti(*), M. Farooq Addas, Abdul Wahab
Faculty of Engineering Islamic University in Madinah, Saudi Arabia
(*)*Emails:* draqbhatti@iu.edu.sa, draqbhatti@gmail.com

ABSTRACT

One of the major natural calamities is earth quake, which come arise due to ground shakes. The variations of earthquake forces are random and have different intensity from place to place. Low rise buildings easily withstand against these accelerations as compared to high rise buildings which are succumbed to damage more rigorously. The Western region of Saudi Arabia lies in low to moderate seismicity regions. Majority of the structures built are seismically active & are designed primarily for combination of gravity and wind loads with no consideration of seismic loading. The areas near the holy city of Madinah city recorded seismic events of magnitude 5.7 in 2009.Therefore the performance based analysis of buildings are required to understand the seismic performances. The seismic design of masonry in-filled RC frame buildings is handled in different ways across the world.

Keywords: seismic retrofitting, Structural dynamics, earthquake engineering.

INTRODUCTION

Structures are vulnerable to Earthquakes and dynamic loading and they must be properly evaluated in design, as they greatly affect stability. The key factor is acceleration which is based on concept of Performance based seismic design. In this method, a model is developed using seismic design to comprehend the structural real behavior (ASCE 2010). The Western region of Saudi Arabia lies in low to moderate seismicity regions. Majority of the structures built are seismically active & are designed primarily for combination of gravity and wind loads with no consideration of seismic loading Alguhane (2014). The areas near the holy city of Madinah city recorded seismic events of magnitude 5.7 in 2009. Therefore, analysis of such buildings is required to understand the seismic performances. (Bhatti 2013, 2016, Varum et al., 2013).

RESULTS AND CONCLUSIONS

This study focuses on performance based seismic design (PBSD) of high rise buildings of commercial and residential area of the Madinah province of Saudi Arabia. These buildings were constructed in late eighties and early nineties. The selected buildings are modeled in SAP 2000 and pushover analysis (nonlinear static analysis) is done, subjecting to monotonically increasing loads until the performance level is achieved. Nonlinear static procedure is simply based on the assumption that the response of a structure can be related to the response of an equivalent single degree of freedom system. The simulation models of the building are shown in Fig. 1. and Fig 2 for unbraced frame and braced framed respectively.

The results from analysis are shown in various hing colours. The fourteen hinges fall in collapse point (CP) and two hinges in collapse for unbraced frame. However by providing cross bracing the collapse point hinges and collapse hinges will be shifted within the safety limits.

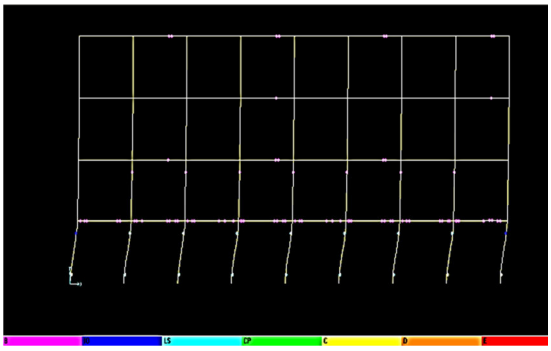

Fig. 1 - Formation of Hinges for Unbraced Model

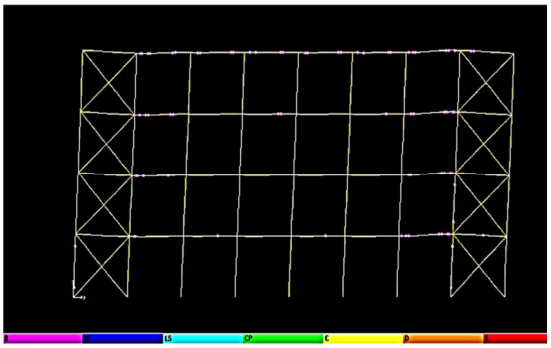

Fig. 2 - Hinges for Braced Model

ACKNOWLEDGMENTS

The authors gratefully acknowledge the funding by Islamic University in Madinah, KSA under Grant No. 37/T/69.

REFERENCES

[1]-ASCE 7-10 (2010) "Minimum Design Loads for Buildings and Other Structures", Published by the American Society of Civil Engineers, ASCE/SEI 7-10.

[2]-Bhatti A. Q. (2013) Performance of Viscoelastic dampers (VED) under various temperatures and application of Magnetorheological dampers(MRD) for seismic control of structures, Mechanics of Time Dependent Materials (MTDM), Volume 17, Issue 3, 2013, pp. 275-284, Springer, Impact Factor 1.472, ISSN: 1385-2000, http://dx.doi.org/10.1007/s11043-012-9180-2.

[3]-Bhatti A.Q. (2016) Application of Dynamic Analysis and Modelling of Structural Concrete Insulated Panels (SCIP) for Energy Efficient Buildings in Seismic Prone Areas, Elsevier Journal of Energy and Building, Accepted, 2016, Vol. 128, pp. 164-177, ISSN: 0378-7788, http://dx.doi.org/10.1016/j.enbuild.2016.06.049.

[4]-Varum H, Teixeira-Dias F, Marques P, Pinto A and Bhatti A. Q. (2013) Performance evaluation of retrofitting strategies for non-seismically designed RC buildings using steel braces, Bulletin of Earthquake Engineering, Volume 11, Issue 4, 2013, pp. 1129-1156, Springer, Impact Factor 1.368, 1570-761X, Accepted, Available Online, http://dx.doi.org/10.1007/s10518-012-9421-4.

[5]-Alguhane, T. M. (2014). Monitoring of buildings structures in Madinah", Ph.D., Ain Shams University Faculty of Engineering 2014.